

COMMON DATA FORMAT TELEMETRY DATA DISTRIBUTION OBJECTPACKETS

OVERVIEW

Telemetry data retrieved from merged flat files or the data warehouse by both users and applications will be delivered via telemetry packet objects. The format for these objeepackets and the data they contain is referred to as the Common Data Format (CDF). Other formats may be defined in the future to provide greater flexibility to users of the data. DCDF is similar in structure to the format used for data produced by the Front End Processor will have a similar format, which is referred to as the FEP Output Format (FOF). FOF differs from CDF in the following ways: (1) the FOF Header ObjectRecord contains two additional time fields used in the merge process; (2) the CDF Element ObjectRecord contains an 8-8-character Mnemonic ID and the FOF does not; and (3) the FOF Element Object does not contain the EU- type field and the EU value field is always 4-byte floating pointRecord contains both the raw and EU-converted values in separate fields while the CDF contains only one field that can hold either one (if both are desired, two element records would be required). Details of the FOF are provided in a separate document.

An Application Program Interface (API) will be provided to isolate the end-user from format concerns. The API will contain all the necessary methods for extracting data and presenting it to the user.

DETAILS

Each telemetry objeepacket consists of a single telemetry data packet. Each packet will consist of a header objectrecord containing meta-data about the packet followed by telemetry element objectrecords. Each telemetry element objectrecord contains one spacecraft telemetry or derived parameter in one of several different formats raw and Engineering either raw form or as a converted and appropriately formatted Engineering Unit value, along with its numeric and Unit formats, along with its numeric identifier mnemonic identifiers and associated flags.

There is a packet for each unique spacecraft time for which telemetry data is received. For 4 Kbps telemetry, this is one packet per minor frame; for 32 Kbps data, it's there are two packets per minor frame. This is because 32-Kbps minor frames are read into spacecraft computer memory in two halves. Thus while minor frames are generated at 20 Hz, the actual data sampling occurs at 40 Hz. The data stream consists of the header record for a specific time followed by a telemetry element object for each decommutarecord for each requested parameter corresponding to that time.

Descriptions of the Telemetry Data Objee record formats are provided in Table 1 below.

Table 1. Definitions of Fields in the CDF

Item Name	Bit Size	Type	Item Description
CDF Packet Header			

Item Name	Bit Size	Type	Item Description
<u>ObjectRecord</u>			
Spacecraft Time	64	IEEE Flt. Pnt.	Time defined by the vehicle clock count converted to UTC and expressed as modified Astronomical Julian Day. For test data, this field will contain CCS Time when presented to the user if the data capture process was configured to store the data by CCS time during the test.
Number of Elements	16	positive integer	Number of Telemetry Element <u>ObjectRecords</u> in the packet
Data Source	8	bits	Identifies various characteristics of the data source as shown in Table 2.
Telemetry Format	8	positive integer	Identifies telemetry format. Integer codes between 0 and 255 will be assigned to all existing formats as shown in Table 3. Additional codes will be assigned for new formats as necessary.
CDF Element <u>ObjectRecord</u>			
Numeric ID	16	positive integer	Unique numeric identifier for the parameter
Mnemonic ID	64	ASCII	Human readable abbreviation identifying the parameter
<u>Data Type</u>	<u>8</u>	<u>ASCII</u>	<u>Indicates the format of the Data Value field; R = raw; F = 4-byte float; D = 8-byte double precision; C = 8-byte character; NOTE: the requirement for double precision has not been established and is being included for possible future expansion.</u>
<u>EUData</u> Value	32 or 64	IEEE Flt. Pnt.	Parameter value <u>in either raw or</u> converted to engineering units; format depends on value of <u>EU-TypeData Type field</u>
Flags	16	bits	Associated flags (see Table 4)

Notes

1. Numeric ID is a unique integer assigned to each telemetry point for the life of the mission even if the point is subsequently eliminated.
2. The Mnemonic ID is not stored in the data base, but is generated only for display and identification purposes. It can be produced by table lookup at retrieval time so the software is simple. Originally, we proposed having only the Numeric ID. When users requested the Mnemonic ID, we considered removing the Numeric ID, but since it is only two bytes, we decided to leave it in because it might be useful to some people.

3. Data gaps are identified in two ways. At the data stream level, a Boolean pseudo-parameter is used that indicates data presence or absence. The gap pseudo-parameter is set to 1 if no data is received for a period of time greater than some threshold which could be one minor frame interval or some longer period of time (**TBD**). The gap pseudo-parameter will change value at the beginning and end of each contiguous data span. At the element level, the Initial Point Flag and Final Point Flag indicate the beginning and end of contiguous data spans for a single element. There may be a gap in an element, even though the gap pseudo-parameter never indicates a gap in the data stream, if a portion of a minor frame is lost. It remains to define the interval thresholds used to set the gap flags and the gap pseudo-parameter. The precise definition of a data gap is **TBD**.
4. The data source flags are all set in the FEP and simply transferred from the FOF to the CDF.

Table 2. Definitions of Flags in the FOF/CDF Header Data Source Field

BIT	FLAG NAME	DESCRIPTION
0 (lsb)	Spacecraft Data Mode	0 indicates recorded data (ETR/SSR) 1 indicates Real-Time data
1	Ground Station Mode	0 indicates direct feed through ground station 1 indicates replay of ground station recorded data
2	CCS Mode	0 indicates operational data 1 indicates test data
3	FEP Mode	0 indicates external data source 1 indicates FEP is replaying pre-recorded data for testing
4	FEP Replay	Set to 1 if data is being supplied in response to an FEP replay request
5	Era	0 if data was captured by CCS 1 if data was converted AEDP/ESS data
6-7	Spare	

Table 3. Telemetry Format Identifier Code Definitions for the FOF/CDF Header

Code	Format	Code	Format	Code	Format	Code	Format
0	off	37	HF	80	PN	163	U
5	XN	40	FN	81	PF	186	ZN
6	XF	41	FF	82	NSSC-1 Dmp	187	ZF

24	TN
25	TF
36	HN

48	C
64	YN
65	YF

138	M
145	S
146	D/E

192	AN
193	AF
others	spare

Table 4. Definitions of Flag Bits in the FOF/CDF Element Flags Field

BIT	FLAG NAME	SET BY	DESCRIPTION
0 (lsb)	Corrected Spacecraft Time	FEP and Merge	Set to 1 if VCC was bad and S/C Time has been corrected; also used for D/E format data
1	Quality	FEP	Set to 1 if data quality is questionable
2	Limit Low	FEP	Set to 1 if out of limits low
3	Limit High	FEP	Set to 1 if out of limits high
4	Limit Level	FEP	Set to 1 if beyond severe limit (red)
5	Delta Error	FEP	Set to 1 if delta limit exceeded
6	Alternate limits	FEP	Set to 1 if alternate limits should be used
7	EU Conversion Error	FEP	Set to 1 for conversion error
8	No EU Conversion	FEP	Set to 1 if no EU conversion is defined in the PRD for this element
9	Initial Point	FEP	Set to 1 if first point after data gap, start of contiguous span
10	Final point	Merge	Set to 1 if last point before gap, end of contiguous span
11	Reconstructed Point	Data Mgt	Set to 1 if this point was added to "changes only" data to construct "all points" data.
12-15	Spare		